

Zero Retries issue 0087 2023-02-24

Zero Retries is an independent newsletter about technological innovation in Amateur Radio. Zero Retries promotes Amateur Radio as (literally) a license to experiment with radio technology.

About Zero Retries

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Request To Send

Zero Retries email readership is now **750+**! This doesn't count readers via RSS (which there is no way to measure). Thanks for the ongoing votes of confidence folks!

As I read my various sources of news every week, I bookmark anything that I consider Zero Retries Interesting, either with my bookmarking system for web pages, or add a tag to email messages. There's a *lot* of technological innovation occurring in Amateur Radio, and adjacent to Amateur Radio! It could be a full time job to try to mention everything I bookmark and tag. Given the size constraints that Substack imposes for "acceptable" email newsletters, I could probably fill up *three* newsletters every week.

Then there are some weeks, like this one, that I don't even *get to touch the bookmarks or email tags* - a few highly interesting topics crowd out everything else.

de Steve N8GNJ

ARISS announcements at HamCation 2023

By Steve Stroh N8GNJ

Digital [Fast Scan] Amateur Television (DATV) is returning to the International Space Station (ISS) in

2023!

I'm a fan of the **Amateur Radio on the International Space Station (ARISS)** program, both personally, and from a Zero Retries Interesting perspective. When explaining Amateur Radio to a techie (or non-techie), mentioning that there is an Amateur Radio station... actually *two Amateur Radio stations*, on the ISS is a proud boast.

Thus, I thought these ARISS announcements from [HamCation](#) 2023 were notable:



Image courtesy of Amateur Radio on the International Space Station (ARISS)

The most immediate Zero Retries Interesting item was that (“fast scan”) television transmissions from the ISS will resume in 2023:



Just announced at HamCation 2023...



Ham TV scheduled to fly to the ISS on the April Cignus NG-19 ISS resupply mission. Installation planned for May.



Image courtesy of Amateur Radio on the International Space Station (ARISS)

This is exciting news because my observation is that our society has substantially shifted to “video first”¹ for information consumption, and thus ARISS activities that include video will be more attractive and relevant to many.

The most complete description that I can find of Digital Amateur Television (DATV) on ARISS is [here](#) (though it’s a bit dated given the references to Windows XP). The big points (to me) of DATV on the ISS are:

- DATV is a mature system in Amateur Radio, especially popular in Europe.
- Being digital, its modulation is more robust than analog television, so DATV is more satisfying to receive as the image quality is better than analog.
- A DATV system had been on the ISS some years ago, but the DATV equipment failed. Repair onboard the ISS wasn’t possible, and apparently (?) there was no ground spare unit for an easy swap. My impression from reading old articles is that when years passed that DATV wasn’t operational on the ISS, a lot of people lost interest / hope that DATV would ever be available again from ISS.
- Behind the scenes, the failed ISS DATV system was removed and queued for return to ground, was returned to ground, was repaired, was re-certified for return to the ISS, and is now scheduled to be returned to ISS in mid-2023.

Receiving DATV from ISS isn't simple:

- Transmissions are on 2.3 / 2.4 GHz, thus it requires a high-gain antenna and active azimuth / elevation tracking as the ISS passes are fast and brief.
- DATV uses [Digital Video Broadcasting - Satellite \(DVB-S\)](#) modulation which is widely used for, well, broadcasting from satellites. But it's a bit tricky to use DVB-S as an Amateur Radio Operator. (To date, I haven't found any "Hack a junkbox satellite television receiver to receive DATV" articles.)
- There's some indication that in the years that DATV has been absent from the ISS that receiving DATV is getting easier due to the increasing capabilities and affordability of Software Defined Receivers whose frequency range includes 2.3 / 2.4 GHz.

I think that once DATV capability is restarted on the ISS, seeing digital images from space is going to add a new dimension of interest in ARISS, along with voice and data.

The best resource that I've found about DATV overall is the [British Amateur Television Club \(BATC\)](#). BATC is definitely Zero Retries Interesting, with an excellent newsletter - [CQ-TV](#) and a wealth of information about DATV including a [Wiki](#). I simply haven't taken the time to bring myself up to speed on DATV, but BATC is an excellent resource.

However, DATV returning to the ISS wasn't the only Zero Retries Interesting announcement from ARISS at HamCation 2023:

- It was exciting to read² that ARISS is in discussions for Amateur Radio stations / systems for successor space stations in Earth orbit and the [Gateway space station planned for orbit around Luna](#). My *impression* is that ARISS reporting out at Hamcation 2023, that there are *substantive* talks underway, indicating that Amateur Radio systems are a real possibility as part of those programs.
- It's Zero Retries Interesting that ARISS-USA was able to attract Diana Schuler, formerly of NASA, to lead ARISS-USA's proposed (and funded!) [STEREO and SPARKI programs](#) for enhancing ARISS educational activities that will soon include providing equipment and a fully developed curriculum for teachers.

Goodspeed, ARISS!

RFzero - Software Defined *Transmitter*

By Steve Stroh N8GNJ

Finally there is a Software Defined Transmitter, that doesn't "bundle" a receiver, thus eliminating the cost, complexity, and compromises of an integrated transmitter / receiver (transceiver) unit.

I've been making the case for some time in Zero Retries that Software Defined *Receivers* is a solved problem. There are many good choices for Amateur Radio SD receivers such as units from [RTL-SDR](#), [SDRplay](#), [Airspy](#), [KrakenSDR](#), etc.

Thus, perhaps it's time to reexamine the prevailing paradigm that a "radio" is assumed to be a transceiver - a transmitter and a receiver in the same unit... with the attendant compromises.

Thus, the [RFzero Software Defined Transmitter](#) was a welcome discovery!

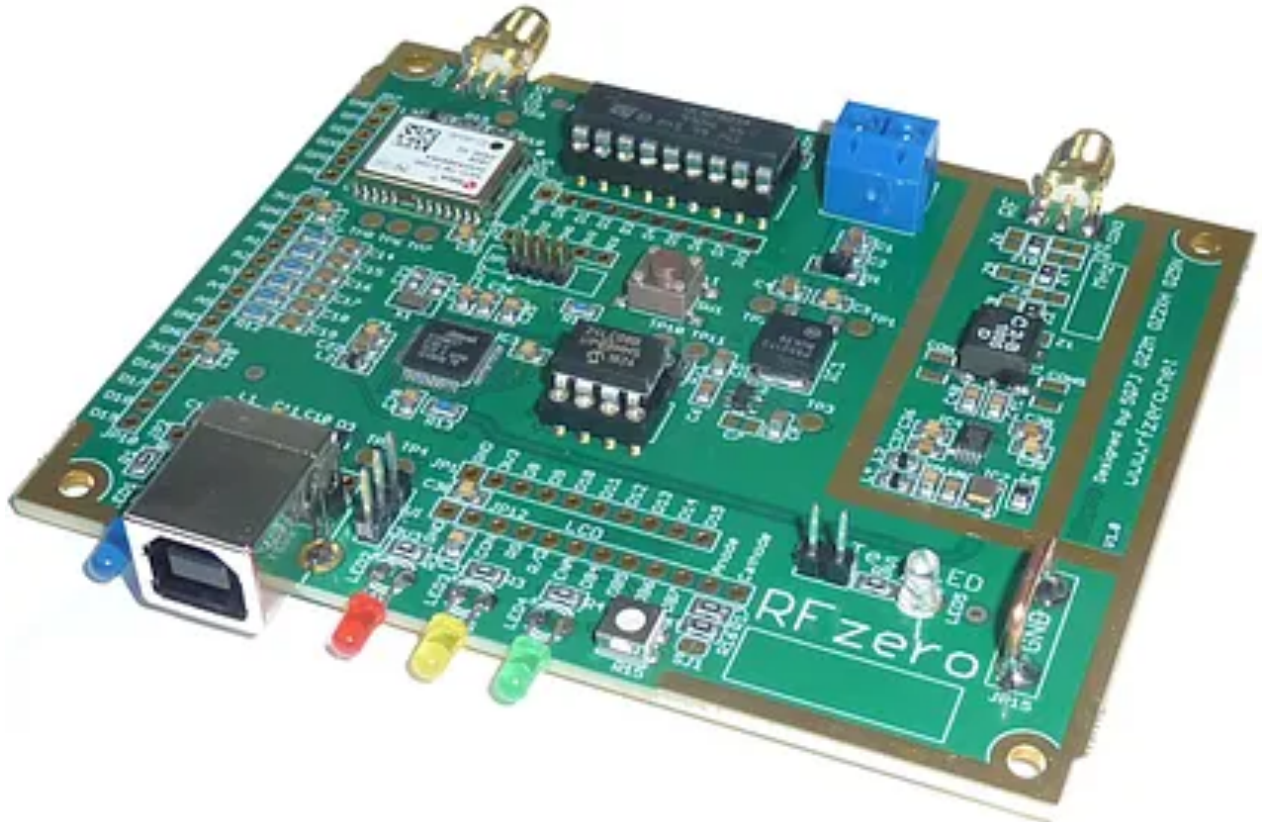


Image courtesy of RFzero

The RFzero™ is an Arduino multi-purpose GPS controlled Si5351A RF unit. It can be used as a beacon (IBP, SPB, CW, FST4, FST4W, FT4, FT8, JS8, JT9, ModeX (JT65, Q65, ...), PI4, WSPR, ...), stand alone WSPR/FST4W transmitter, signal generator, VFO, QO-100 dual LO, low cost GPSDO, e.g. for 10 MHz, IC-9700 LO, 90 MHz frequency counter or ... More than 35 programs, Arduino sketches, are integrated into the Arduino IDE, so you can write or modify the software yourself. With the RFzero Manager you don't even have to know anything about Arduino to use the RFzero™.

The RFzero™ can generate frequencies [between 2.289 MHz and nearly] 300 MHz. At the same time 28 I/O pins are available and eight of those are via an ULN2803A power driver. The programming and configuration are done via the USB port, thus no extra hardware programmer is needed.

The RFzero™ has been developed for radio amateurs, RF enthusiasts and everyone else who wants to extend their Arduino skills in combination with RF. The RFzero™ board is largely compatible with the Arduino Zero and Arduino M0+ boards. However, it has been carefully designed for flexible use in RF applications and with attention to the frequency spectrum and stability performance. Many users say that the RFzero™ is the best Si5351A RF solution available.

All of that for < \$100 (not including shipping and accessories)!

As with most Software Defined Transceivers / Transmitters, the output power from the RFzero is minuscule (~20 milliwatts (mW)). But this is addressed by RFzero - see their [Shop page](#) for references to building a power amplifier³ for 144 -148 MHz (2 meters) that will amplify to 4 watts (W) and another power amplifier for 1240 - 1300 MHz (23 centimeters) that will amplify to 2W. RFzero has thought

through many issues and provided needed accessories and advice such as how to calculate values for power amplifiers for a particular band. For example, the US 219 + 222 - 225 MHz band isn't mentioned, but it seems straightforward to calculate the values needed to populate an RFzero "FET amplifier" board for that band.

And in referencing the RFzero shop... that's the *most refreshing part* of RFzero - hardware is *available*. It's developed! It's *shipping*! You're not putting down a deposit on a project that may or may not produce hardware (as has been my experience to date with Crowd Supply and the [CaribouLite RPi Hat](#) that I *still* haven't received).

One of the benefits of a separate receiver(s) and transmitter(s) is that with no need to do transmit / receive switching, full duplex (FDX) is a possibility. It's also possible to "integrate" the transmit and receive functions in software to approximate a transceiver's simplicity of operation and blend the transmit and receive functions seamlessly... at least in concept (it's a "simple matter of software").

I look forward to following the RFzero and learning more about it from the [RFzero mailing list](#).

RPX-100 Update

By Steve Stroh N8GNJ

The [RPX-100](#) is a project in progress by the Austrian Amateur Radio Society (Österreichischer Versuchssenderverband - ÖVSV) to develop an open source Software Defined Transceiver for the Amateur Radio 50-54 MHz (6 meters), 144-148 MHz (2 meters), and 430-450 MHz (70 centimeter) bands. It's intended to be used for high(er) speed data communications for VHF / UHF connectivity to the (Europe) [HAMNET](#) network.

I've been following the development of the RPX-100 for some time now. I was planning to reach out to the project to see how it's progressing since they received a grant from ARDC 2022-034. In my background research prior to contacting them, I found a slide deck - [Wideband Digital Transmission in the 6m Band - Last Mile for HAMNET](#) (Google Slides) dated 2023-01-15 that provided a comprehensive update.

Terse summary from the slide deck:

- The team has grown to seven members with a wide array of expertise.
- Construction of ten prototype units and field testing using those units will commence by mid-2023.
- General availability of the RPX-100 as a completed design, and potentially, [kits to build an RPX-100](#), won't be earlier than 2024.

As noted in the prior article, a common issue in using Software Defined transceivers / transmitters is low transmit power. Thus it's notable that the RPX-100 is built around a LimeSDR Mini (with low transmit power), using a new design for a [6m / 2m / 70 cm 30 watt power amplifier](#).

ZR > BEACON

- [Microchip \(Technology Inc.\) University - Getting Started With Radio Frequency Applications](#)
This class is for engineers who want to learn about UHF based systems. Concepts covered include RF working principle, synchronization and data communication as relates to typical applications. UHF based systems can be designed very easily - we promise! Interested in how it works and what it

can be used for? This class is for engineers who want to learn about UHF based systems. Concepts covered include RF working principles, synchronization and data communication as it relates to typical applications. If you need to transfer data without wires with low effort, with low power and without knowledge about standards like BLE, investigate the UHF world. You will learn how to use our UHF devices and explore the performance with our demo kit.

- **MikroTik (Wireless) for Grandparents**

For those that haven't heard of [MikroTik](#), it's a small company based in Riga, Latvia that manufactures innovative and cost-effective equipment for networking, Wi-Fi, and Wireless Internet Service Providers (WISPs). MikroTik has some crossover into Amateur Radio as some of their products are used for Amateur Radio microwave networking in [HamWAN](#) and [AREDN](#). I've been a fan of MikroTik since their founding in 1996 and although I don't currently write about commercial wireless where MikroTik products are used, I check in on their progress every so often. Thus I was amused when I spotted these two videos:

[MikroTik for Grandparents 1: DON'T HIDE THE ROUTER!](#)

[MikroTik for Grandparents 2: The Frequency Spectrum](#)

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out

Join the Fun on Amateur Radio for some pointers.

Zero Retries Frequently Asked Questions (FAQs) - In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing *Thanks* to:

- Tina Stroh KD7WSF for, well, *everything!*
- Pseudostaffers [Dan Romanchik KB6NU](#) and [Jeff Davis KE9V](#) for continuing to spot, and write about "Zero Retries Interesting" items on their blogs that I don't spot on my own.
- [Amateur Radio Weekly](#) consistently surfaces "Zero Retries Interesting" stories.
- Andreas Spiess HB9BLA's YouTube channel - [HB9BLA Wireless](#) features Zero Retries Interesting content.
- Matthew Miller M0DQW's YouTube channel - [Tech Minds](#) features Zero Retries Interesting content. It's subtitled Ham Radio - SDR - RF Projects - Software - Tutorials.
- If you like the content of Zero Retries, I recommend [Experimental Radio News](#) by Bennet Z. Kobb AK4AV. ERN discusses (in detail) Experimental (Part 5) licenses issued by the US FCC.
- The [Substack email publishing platform](#) makes Zero Retries possible. I recommend it for publishing

newsletters.

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Zero Retries (N8GNJ) is on Mastodon - n8gnj@mastodon.radio - just click:

[Zero Retries / N8GNJ on Mastodon](#)

Email issues of Zero Retries are “instrumented” by [Substack](#) to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- [N8GNJ blog](#) - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!

Steve Stroh N8GNJ / WRPS598 (He / Him / His)

These bits were handcrafted in beautiful Bellingham ([The City of Subdued Excitement](#)), Washington, USA.

2023-02-24

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Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I owe them from way back).

[1](#)

Being a “text first” person (reader), this is a reluctant observation on my part.

[2](#)

Despite having a [YouTube channel](#), there's no video of the ARISS seminar at Hamcation 2023. Bummer!

[3](#)

While the RFzero is assembled, the RFzero “FET amplifier” is supplied as a bare printed circuit board with no components; it’s left to the purchaser to source the needed components. This seems like a good opportunity for a third party to buy boards and build up assembled power amplifiers, such as for the US 219 + 222-225 MHz band.

[4](#)

Through 2022, I was prohibited from reaching out to the RPX-100 team because they received an ARDC grant and I was on the ARDC Grants Advisory Committee.